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(54) **Process for the recovery of raw materials following the demolition of kinescopes and recovered products thus obtained**

(57) A process for the recovery of raw materials following the demolition of kinescopes, comprising a picking step of the ferrous material contained in the kinescope, a mechanical removal step of the layer of phosphor deposited on the front surface of the screen of the kinescope and a demolition step of the glass, which is thus reduced into portions of various shapes and sizes; then it is foreseen to carry out a manual selection of the crystal portions of the screen, which are separated from the glass portions of the cone of the kinescope, and, then, placed

in one or more barrel, kept in depression, or rotary washing machines, in which water is flowed, with possible addition of one or more dye, at a predetermined temperature, from which the powders and small waste pieces are taken. A product that is smoothed, rounded and/or beaten, able to be used as a screen for illuminating light sources and/or able to be used as an ornament or in the fancy goods industry in general is thus obtained.

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Description

[0001] The present invention refers to a process for the recovery of raw materials following the demolition of kinescopes.

[0002] The scope of the invention extends analogously to the recovered products thus obtained, which, wash in the described way, can be recycled and reused as components of illumination apparatuses (screens) or else for purely ornamental purposes (such as decorative items).

[0003] The kinescope of television sets, computers, etc. mainly consists of a glass cone, having a capsule of ferrous material inside it.

[0004] The front surface of the kinescope (screen) is made from crystal and it is coated with a layer of small phosphor particles, which, during operation of the kinescope, are hit by the electron beam, suitably directed and deflected, to obtained a selective illumination of the various portions of the screen.

[0005] The particular manufacture of the kinescope causes substantial problems of disposal and recycling of raw materials, since it is difficult to separate the materials of which it is made, necessary for the collection and reuse thereof, both technically and from an environmental point of view.

[0006] Moreover, it has not yet been possible to obtain a substantial recovery of raw materials, following the treatment of old kinescopes.

[0007] The coming into force of Italian legislative decree no. 22/97 has made the environmental problem concerning the disposal of old electrical and electronic apparatuses, such as kinescopes, even clearer since, even if treated through suitable treatment processes in order to obtain the maximum recovery of raw materials, such recovery does not achieve significant percentages compared to the overall amount of waste treated following such treatment.

[0008] The remaining fraction of unrecoverable waste must therefore be sent, in an uncontrolled way, to definitive disposal in a dump, with the relative consequences linked to the methods of transportation, to the overall bulk and, last but not least, to the costs to be borne for disposal in the dump.

[0009] Therefore, it is clear from what has been said above that there is an increasingly important need to carry out a progressive and constant reduction of the unrecoverable fraction of waste, to be sent to the dump, deriving from the treatment of old kinescopes.

[0010] The purpose of the present invention, therefore, is that of avoiding the aforementioned drawbacks and, in particular, that of indicating a process for the recovery of raw materials following the demolition of kinescopes, which allows the unrecoverable fraction of waste, to be sent to the dump, to be progressively reduced.

[0011] Another purpose of the present invention is that of indicating a process for the recovery of raw materials following the demolition of kinescopes, which is extremely reliable and that allows a clear saving of the recycling

and storage costs, as well as a substantial reduction in the bulk of waste obtained following the demolition process of the kinescope, to be obtained.

[0012] Another purpose of the present invention is that of indicating a process for the recovery of raw materials, which ensures complete safety for the worker during all of the division and purging steps.

[0013] A further purpose of the present invention is that of obtaining a recovered product, following the demolition of kinescopes, which can be reused in various uses, in order to increasingly limit environmental problems.

[0014] The last but not least purpose of the invention is that of obtaining a recovered product, following the demolition of kinescopes, which is easy and cost-effective to make and easy and simple to use.

[0015] These and other purposes are accomplished by a process for the recovery of raw materials, following the demolition of kinescopes, according to claim 1, and by the recovered product thus obtained, according to claim 10, to which we refer for the sake of brevity; other detailed characteristics of the process and of the recovered products are shown in the subsequent claims.

[0016] Further purposes and advantages of the present invention shall become clear from the following description, relative to a preferred but not limiting example embodiment of the process for the recovery of raw materials, following the demolition of kinescopes, and of the recovered products thus obtained.

[0017] The separation of the various materials that make up the kinescopes, in order to obtain the maximum recovery of raw materials from them, takes place according to treatment processes that can foresee manual or else automated operations.

[0018] For example, the separation of iron, which constitutes the outer frame of the screen of kinescopes, from the crystal of the screen and from the glass of the cone can be carried out by hand, through a fixed circular saw and/or through a laser cutting operation, or else by means of magnetic systems.

[0019] Similarly, the brushing of the phosphor powders can be carried out manually, through suitable instruments, in order to obtain optimal sizes of the components for their remelting; regarding this, further fragmentation and sorting operations of the removed and divided material are necessary.

[0020] As an alternative to the manual mechanical brushing operation of the phosphor powders present on the surface layer of the screen of a kinescope, it is also possible to carry out the cleaning by means of chemical components, capable of removing the layer of phosphor from the glass panel and separating the powders from the resinous matrix that acts as glue during the chemical reaction; it is clear that in this case it is necessary to pay due attention to the further recovery of the chemical substances used.

[0021] The treatment process can furthermore be carried out in an automatic or automated way, by means of specific machines, suitable for carrying out the demolition

of the kinescope and the simultaneous cleaning of the glass from the phosphor particles.

[0022] In such a case, the kinescope to be demolished is inserted inside the machine, through a suitable opening, so that a suitable turnover mechanism, comprising a press, allows the kinescope to be pressed for its complete demolition.

[0023] In particular, the pressing takes place in such a way as to ensure a controlled demolition of the glass of the kinescope and, moreover, in the pressing step, in order to hook the frame of ferrous material of the kinescope, a loading and guide piston is used, which is moved in a way and with a force such as to perforate the mask of the kinescope.

[0024] Moreover, the machine comprises an automatic brushing system of the layer of phosphor present on the front surface of the glass of the kinescope, a collection and transportation device (guide or conveyor belt on rollers) of the glass, which comes away by falling, and a suction device of the phosphor powder that has detached from the glass of the kinescope during the brushing and pressing step.

[0025] According to the present invention, in output from the demolition machine of kinescopes, i.e. following the manual cutting and brushing operations of the screen, it is possible to first of all carry out a manual selection of the fragments (being of various shapes and sizes) of crystal of the screen of the kinescope, which are separated from the fragments of glass of the cone of the aforementioned kinescope, so that the glassy material in general (fragments of crystal of the screen + fragments of glass of the cone), which is normally treated as unrecoverable waste, can thus be reused, in order to obtain the maximum recovery from them.

[0026] Indeed, such fragments are transported automatically or manually inside one or more washing machines and made to roll inside a basket or other containment element, rotating in a single direction or, alternatively, in one direction and in the opposite direction; in particular, the fragments of glassy material can be positioned inside a machine, such as a washing machine and/or an agitator body (or tumbler), the containment element of which is basket shaped, contains a suitable amount of water where the fragments are immersed and rotates in one direction and/or in the opposite direction.

[0027] In alternative embodiments, the fragments can be transported, automatically or manually, inside one or more agitator body or containment tumbler, the inner basket of which rotates in a single direction or else in one direction and in the opposite direction, for predetermined times.

[0028] Each tumbler can be kept in depression and made to work dry, in order to obtain fragments of glass and/or crystal suitably shaped and smoothed.

[0029] In such a case, the definitive shape of such fragments is obtained by abrasion of the glassy material, which continues to roll inside the basket of the tumbler, in one direction and/or in the opposite direction, followed

by a suction step of the powders and of other portions of material detached from each fragment following the movement of the aforementioned basket.

[0030] It has also been noted, from experimental tests, that the best results were obtained by using a washing machine, the basket of which rotates, in the presence of water at a variable temperature between 30 and 70 °C, in a single direction, or else by using an agitator body or tumbler, working dry, the basket of which rotates, in the presence of water at room temperature, for a certain period of time, in one direction and, for another determined period of time, in the opposite direction.

[0031] In the case in which a washing machine is used, it is also possible to add one or more dyeing substance to the washing water of the fragments of glassy material, in order to obtain a coloured surface finish.

[0032] The containment element of the fragments (basket of the washing machine or basket of the tumbler) is finally equipped with a series of holes, of suitable sizes, suitable, during movement and through the help of a pump, for discharging the powders and the small pieces of crystal and/or glass that form due to the continuous collisions of the fragments against the walls of the basket of the washing machine or of the tumbler.

[0033] In such a way, fragments of crystal and/or glass, of various shapes and sizes and possibly coloured on the surface, are obtained, which are suitably smoothed, rounded and/or beaten, following the treatment described above.

[0034] The fragments can, finally, be picked up, after the discharge of the powders, and sent to an automated final collection and transportation plant.

[0035] It is thus possible to obtain the maximum recovery of such fragments, since, thus treated, they can be advantageously used both as screens of generic light sources and as decorative elements for vases, fountains, aquaria and for the fancy goods industry in general.

[0036] From the description that has been made the characteristics of the process for the recovery of raw materials following the demolition of kinescopes and of the recovered products thus obtained, which are the object of the present invention, are clear, just as their advantages are also clear.

[0037] It is clear that numerous other variants can be brought to the recovery process and to the products in question, without for this reason departing from the novelty principles inherent to the inventive idea, just as it is clear that, in the practical embodiment of the invention, the materials, the shapes and the sizes of the illustrated details can be whatever according to requirements and they can be replaced with other equivalent ones.

Claims

1. Process for the recovery of raw materials following the demolition of kinescopes, comprising a first picking step of the ferrous material contained in the ki-

nescope, a second mechanical removal step of the layer of phosphor deposited on the front surface of the screen of the kinescope and a third demolition step of the glassy material of which the kinescope consists, which is thus reduced into fragments or portions of various shapes and sizes, **characterised in that**, after the demolition operation of the glassy material, the following further steps are foreseen:

- a transportation and depositing step of the portions of glassy material into at least one rotary containment element;
- a moving step of said at least one containment element, in order to suitably smooth said portions of glassy material;
- a picking step from the containment element of powders and small waste fragments of glassy material, which are produced by abrasion during the movement of the containment element.

2. Recovery process according to claim 1, **characterised in that**, after the picking step, a removal step of the portions of glassy material, which constitute the finished recovered products, is foreseen.

3. Recovery process according to claim 1, **characterised in that** said at least one rotary containment element is housed in one or more washing machines, in which washing liquid is made to flow at a predetermined temperature.

4. Recovery process according to claim 1, **characterised in that**, after the demolition operation of the glassy material, it foresees a selection step, from amongst said glassy material, of the portions of crystal of the screen of the kinescope, which are separated from the portions of glass of the cone of the kinescope.

5. Recovery process according to claim 1, **characterised in that** said at least one containment element is inserted inside at least one agitator body or tumbler, suitable for working dry and/or in depression.

6. Recovery process according to claim 3, **characterised in that** it foresees a step of addition of one or more dyeing substances to said washing liquid of said machine.

7. Recovery process according to claim 1, **characterised in that** said at least one containment element rotates in one direction or, alternatively and for determined periods of time, in one direction and in the opposite direction.

8. Recovery process according to claim 1, **characterised in that** said picking step of powders and small waste fragments of glassy material is carried out

through a suction process, through at least one pump.

9. Recovery process according to claim 2, **characterised in that**, following the suction steps of the portions of glassy material, which constitute the finished recovered products, it foresees a loading step of the finished recovered products into automation and transportation plants.

10. Recovered product obtained by means of a process according to claim 1, **characterised in that** it has one or more smoothed, rounded and/or beaten surfaces and **in that** it can be used as a screen for illuminating light sources and/or as a decorative element for the fancy goods industry in general.



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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 February 2006	Examiner Muller, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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